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Proceedings of the regional peer review on the assessment of the status of the southern Gulf of St. Lawrence snow crab (*Chionoecetes opilio*) stock

January 25 and 26, 2017
Moncton, NB

Chairperson: Marc Lanteigne

Fisheries and Oceans Canada
Science Branch
P.O. Box 5030
Moncton, NB, E1C 9B6

April 2017

Canada

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

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SUMMARY

A regional advisory process meeting was held January 25 and 26, 2017 in Moncton (NB) to conduct a science peer review of the status of the snow crab (*Chionoecetes opilio*) biological unit of the southern Gulf of St. Lawrence (sGSL). The science review was conducted in response to a request from DFO Fisheries and Aquaculture Management (FAM) for advice on the status of stock in 2016 and catch advice for the 2017 fishery. The assessment on the status of the southern Gulf snow crab resource (Areas 12, 19, 12E and 12F) is based on fishery independent trawl surveys that provide indicators of abundance (commercial biomass), reproductive potential (abundance of mature females) and recruitment. Participants at the science review included science staff from the DFO Gulf Region, personnel from DFO FAM Gulf region, from universities, from aboriginal communities, from the fishing industry, and from provincial governments. A review of the stock status and the catch advice for the 2017 and 2018 fisheries were presented as part of the Science Advisory Report. The four working papers were recommended to be revised and published as research documents. The Science Advisory Report received consensus at the meeting.

SOMMAIRE

Une réunion régionale scientifique a été tenue les 25 et 26 janvier 2017 à Moncton (NB) afin d'entreprendre un examen scientifique par les pairs sur l'état de la population de crabe des neiges (*Chionocetes opilio*) dans l'unité biologique du sud du golfe du Saint-Laurent (sGSL). L'examen des sciences a été mené en réponse à une demande de la Gestion des pêches et de l'aquaculture (GPA) du MPO pour obtenir des avis sur l'état du stock en 2016 et des avis de capture pour la pêche 2017. L'évaluation de l'état de la ressource du crabe des neiges du sud du Golfe (zones 12, 19, 12E et 12F) est basé sur des relevés au chalut indépendants de la pêcherie, qui fournissent des indicateurs d'abondance (biomasse commerciale), le potentiel de reproduction (abondance des femelles matures) et le recrutement. Les participants à l'examen scientifique inclus le personnel scientifique du MPO de la Région du Golfe, du personnel de la GPA de la région du Golfe, des universités, des communautés autochtones, de l'industrie de la pêche et des gouvernements provinciaux. Un examen de l'état du stock et les avis sur les captures pour 2017 et 2018 ont été présentés dans un rapport d'avis scientifique. Il a été recommandé de réviser les documents de travail et de publier quatre documents de recherche. L'avis scientifique a fait l'objet d'un consensus au cours de la réunion.

INTRODUCTION

A regional science advisory process peer review meeting of the fishery and status of the stock for 2016 and advice for the 2017 snow crab (*Chionoecetes opilio*) fishery of the southern Gulf of St. Lawrence biological unit was conducted in Moncton (NB), January 25 and 26, 2017. The terms of reference (TOR) for the science review were developed jointly by DFO Fisheries and Aquaculture Management and DFO Science Branch, Gulf Region (Appendix 1). The meeting was expected to start at 10:00 AM but due to inclement weather, it began at 1:00 PM, Wednesday January 25, 2017. The meeting ended at 10:30 AM, Thursday January 26.

The chair (Marc Lanteigne) reviewed the meeting room arrangements and indicated that simultaneous translation, provided by interpreters contracted through Public Works and Government Services Canada, was available to participants. The chair reviewed the rules of exchange for the meeting, reminding participants that the meeting was a science review and not a consultation. As well, everyone at the meeting had equal standing as participants as there was no observer status at the meeting. Table microphones were provided to ensure good communication during the meeting, to allow for simultaneous translation of the presentations and discussions and as such, exchanges would have to take place one at a time and, if required, through order of the chair. Finally, the objective was to achieve consensus on the appropriateness of the assessment documents and that for the purposes of the science review, consensus was taken as an absence of opposition. The chair then invited the participants to introduce themselves; the list of participants is provided in Appendix 2. The chair reviewed the terms of reference for the meeting. The draft agenda was reviewed, modified and accepted with the modifications associated with the late start of the meeting (Appendix 3).

A participant from Area 19 requested an addition to the agenda to present an issue related to the ongoing process of consultation to identify Marine Protected Areas (MPAs). The chair sought participant's approval and suggested to add this item as "Other points of discussion" to the "Update on projects associated with the collaborative agreement" identified in the agenda.

Following on a commitment made by DFO Science Branch to provide access to the data from the southern Gulf of St. Lawrence snow crab trawl survey prior to the annual peer review of the stock assessment, the survey data files from the snow crab trawl survey from 2016 were distributed as part of the meeting notification to all potential participating organizations on December 19, 2016 (Appendix 4).

Four working papers (WP) for review by meeting participants were made available to confirmed participants and to all industry and aboriginal organizations prior to the science review on January 17, 2017 (Appendix 5). These working papers were:

- WP 1: Review of the 2016 snow crab (*Chionoecetes opilio*) fishery in the southern Gulf of St. Lawrence (Areas 12, 19, 12E and 12F) by M. Hébert, E. Wade, P. DeGrâce, and M. Moriyasu.
- WP 2: Summary of the 2016 snow crab trawl survey activities in the southern Gulf of St. Lawrence by E. Wade, M. Moriyasu, P. DeGrâce, J.F. Landry, R. Allain and M. Hébert.
- WP 3: The 2016 assessment of the snow crab (*Chionoecetes opilio*) stock in the southern Gulf of St. Lawrence (Areas 12, 19, 12E and 12F) by M. Hébert, E. Wade, P. DeGrâce, and M. Moriyasu.
- WP4: Trends in the biomass, spatial distribution and size composition of snow crab (*Chionoecetes opilio*) based on multi-species bottom trawl survey of the southern Gulf of St. Lawrence, 1980-2016 by H.P. Benoît.

To facilitate the discussions, printed copies of the different presentations were distributed to all participants at the beginning of the meeting. A draft version of the Science Advisory Report was also distributed for review at the end of the presentations. Rapporteur duties were assigned to Gérald Chaput, Renée Allain and Rita Cormier from DFO Science Branch.

This Proceeding constitutes a record of meeting discussions and conclusions.

PRESENTATIONS AND DISCUSSIONS

Printed copies of all the presentations which were summaries of the working papers were distributed to meeting participants at the meeting. Subsequently, electronic versions of the presentations were distributed to the meeting notifications distribution list on January 28, 2017.

REVIEW OF THE 2016 SNOW CRAB FISHERY

The information was presented by Marcel Hébert (DFO Science, Moncton, NB).

The review of the 2016 snow crab (*Chionoecetes opilio*) fishery in the southern Gulf of St. Lawrence (sGSL) (Areas 12, 19, 12E and 12F) was presented. Total landings in the sGSL in 2016 were 21,707 t out of a revised quota of 21,611 t. The allowable quota in the notice to harvesters was 21,759 t. In Area 12, landings were 19,499 t (revised quota of 19,393 t). The mean catch-per unit-of-effort (CPUE) from logbooks decreased in 2016 (64.0 kg per trap hauled (kg/th)) compared to 2015 (67.9 kg/th). The mean size of commercial-sized adult males remained at 111.9 mm of carapace width (CW) in 2015 and 2016. The incidence of soft-shelled crab remained low at 5.3%. In Area 19, landings reached 1,701 t (revised quota of 1,701 t). The mean CPUE remained high in 2016 at 142.5 kg/th and is comparable to 2015 (144.8kg/th). The mean size of commercial-sized crabs remained high in 2015 (114.4 mm CW). The incidence of white crabs increased from 5.5% in 2015 to 8.2% in 2016. In Areas 12E and 12F, landings were 126 t (revised quota of 144 t) and 381 t (revised quota of 373 t), respectively. In Area 12E, the mean CPUE decreased in 2016 (51.5 kg/th) compared to 2015 (65.8 kg/th). The incidence of soft-shelled crab decreased from 9.8% in 2015 to 1.1% in 2016. In Area 12F, the mean CPUE increased from 38.2 kg/th in 2015 to 43.9 kg/th in 2016. The incidence of soft-shelled crabs increased to 10.4% in 2016 compared to 3.3% in 2015.

Discussion

Industry participant asked if the at-sea observer companies (i.e.: Biorex and Javitech) had comparable compliance and performance. DFO-Science indicated that Javitech seems to deviate from the standard protocol to collect catch per unit of effort data (CPUE). For this reason, Javitech data were not considered for the CPUE calculations from the at-sea observer program. This situation was raised in 2016 and 2015 with Conservation and Protection in charge of the at-sea observer program for DFO. This situation does not impact the shoft shell / white crab monitoring program.

Science analyses of the at-sea observer data suggested that Javitech observers are providing an estimate of the number of crabs caught in traps, instead of an actual count as indicated in the protocol.

Industry participants, who are also harvesters from different management areas, were somewhat surprised of this issue of estimates versus counts of number of crabs/trap. Harvesters around the table were unanimous and stated that onboard their vessels, over the years, observers from both companies (Biorex and Javitech) made estimates of number of crabs/trap and not actual counts. They indicated that estimates of counts was the best way to collect this information because of the large number of crabs caught per trap and to keep up

with the pace of fishing traps. This issue will require further investigations and discussion with Conservation and Protection and both observer companies.

SUMMARY OF THE 2016 SNOW CRAB TRAWL SURVEY ACTIVITIES

The information was presented by Mikio Moriyasu (DFO Science, Moncton, NB).

The details of the 2016 snow crab trawl survey of the southern Gulf of St. Lawrence were presented. The primary objective of the survey is to provide the data on abundance and distribution of snow crab and other by-catch species. The results of in-depth analysis of the survey data were presented in the assessment document. The survey was conducted from July 10 to October 4 using a chartered commercial fishing vessel, the "Jean Mathieu". A total of 355 grids were visited and 354 grids were successfully sampled. The total duration of the survey was 87 days with 42 days at sea. Total number of immature male crab captured went from 11,431 individuals in 2015 to 11,431 in 2016, whereas mature male crab catches decreased from 3,755 to 5,452. For commercial-male crabs, the number captured increased from 1,741 in 2015 to 2,896 in 2016. For females, the total number of immature female crabs captured increased from 4,904 in 2015 to 5,547 in 2016, and the number of mature female crabs increased from 7,398 in 2015 to 7,854 in 2016. Recorded by-catch (including snow crab) during the 2016 survey consisted of 71 species/groups comprised of 43 fish including skate egg capsules and 28 invertebrates including whelk capsules and one marine plant.

Discussion

The chair indicated that, in addition to the presentation, more information was posted on a wall of the meeting room. As in previous years, the Science team prepared a poster presenting a map of the trawl survey polygon with a mosaic of photos showing the catch of each tow conducted in 2016. Participants were informed that the information on the poster was also available in electronic format (on a USB memory stick) and was available on request. Participants were invited to contact a member of the Science team to obtain a copy of the photographs.

There was a question from an industry participant about the protocol used during the survey to treat the failed/unsuccessful primary station in any particular grid. If the primary station fails and calls for an alternative station, is the primary station replaced the following year by the new position of the successful alternative station? The answer was yes. It was explained that this is the standard approach adopted. There was however an exception in 2016 as a result of a concern raised by participants of the fishing industry during last year (2016) science peer review. The alternative station that raised concerns (i.e.; high catch of lobster) in area 19 during the 2015 survey was not selected as the new primary station in 2016. Instead, the original primary station from 2015 was used during the 2016 survey and the tow was successful.

To the question on whether the timing of the survey and area fished had an effect on biomass estimates, it was indicated that the timing of fishing a particular area may change slightly from one year to the next but is not deemed to have an impact on the biomass estimate.

THE 2016 ASSESSMENT OF THE SNOW CRAB STOCK

The results of this working paper were presented in segments to allow a logical flow of information and discussions on the key elements of the assessment.

Snow crab stock assessment for the 2017 fishery

The information was presented by Marcel Hébert (DFO Science, Moncton, NB).

The 2016 assessment of the southern Gulf of St. Lawrence (sGSL) snow crab, *Chionoecetes opilio*, stock (Areas 12, 19, 12E and 12F) is presented. Snow crab management Areas 12, 19 12E and 12F comprise a single biological population and the sGSL stock is considered as one unit for assessment purposes. The 2016 assessment was conducted as per the recommendations of the Snow Crab Assessment Methods Framework Science Review held in November 2011. The exploitation rate of the 2016 fishery in the sGSL was 36.9%. The 2016 post-fishery survey biomass of commercial-sized adult male crabs was estimated at 99,145 t (95% confidence intervals 87,749 to 111,600 t), an increase of 68.6% from 2015. The available biomass for the 2017 fishery, derived from the 2016 survey, is within the healthy zone of the PA Framework. The residual biomass (24,876 t) from the 2016 survey remained at the same level as 2015. Seventy-five percent (75%) of the 2016 survey biomass, available for the 2017 fishery, is composed of new recruitment (74,269 t). The recruitment to the commercial biomass from the 2016 survey increased by 112.6% compared to 2015.

Discussion

There were some questions and a discussion around the potential causes for the high incidence of skip molters in the R-2 life stage in 2015. Science participants indicated the possibility of a density dependent interaction; high density of crabs in the population would induce higher incidence of skip molters. When the biomass increases, hard shell crab abundance increases and small size crabs may postpone their molt to maturity. These mechanisms are not well understood. The annual trawl survey can detect the incidence of skip molters during the year of the survey but, cannot provide an indicator of skip molters abundance fluctuations in the future. This situation with skip molters emphasized the value of having an annual trawl survey to assess the status of the exploitable component of the stock.

Industry participants are suggesting that competition between small and large size crabs may be at play. Temperature or environmental condition may play a role but there are no evidences or studies that would link these factors to the prevalence of skip molters.

Can an increase in the incidence of skip molters decrease the overall mean size of harvested crabs? Present knowledge of the biology and growth of this species would not support such relationship between the incidence of skip molters and mean size of commercial crabs. As normal crab molt in January/February, skip molters molt earlier (i.e.: December). Skip molters may achieve harder shell conditions by the time of the fishery but would still be in carapace conditions 1 or 2, therefore would still be white or soft shell.

To the question of the impact of warmer water temperature on the molt cycle, DFO-Science indicated that to a certain point increases in water temperature would increase molt frequency and may increase the size increment at molt. Snow crabs are cold water species and if the water temperature is too high, they may not molt. There are some published information on the growth rate and temperature relationship.

A non-DFO science participant indicated that data are available about the predicted recruitment (R-1 life stage) for the years to come and the estimated recruitment (R-1) from the survey. With some additional exploration work, there is a possibility that these data could be incorporated in the assessment model to account for the incidence of skip molters.

An industry participant asked whether the trawl used presently, with all the new sensors, was more efficient than in the past, and whether this may explain the higher incidence of skip molters. DFO-Science explained that the new sensors on the trawl did not change the behavior or efficiency of the trawl. The sensors were used to confirm that the methodology used in the past to estimate the touchdown of the net was not biased. As old sensors become obsolete, the new sensors will make touchdown determination easier in the future.

Biomass geographic distribution in management areas (including buffer zones)

The information was presented by Marcel Hébert (DFO Science, Moncton, NB).

The kriging polygon (and the survey area) has a total area of 57,840 km2 and is the basis to calculate the total sGSL biomass estimate. As the fishery is managed in four areas, DFO Fisheries and Aquaculture Management as requested estimates by management areas. The sGSL kriging polygon was therefore partitioned into the four management areas. Biomass estimates were also calculated for the unassigned zone A (above Areas 12E and 12F) and the two no-fishing buffer zones (B and C). A table presents the biomasses by area and confidence intervals.

Discussion

An industry participant noted an error in the presentation table showing biomass by management areas. The numbers presented in the working paper were correct and correction of the presentation was made.

TRENDS IN THE BIOMASS, SPATIAL DISTRIBUTION AND SIZE COMPOSITION OF SNOW CRAB BASED ON MULTI-SPECIES BOTTOM TRAWL SURVEY, 1980-2016

The information was presented by Hughes Benoît (DFO Science, Moncton, NB).

The research vessel bottom-trawl survey of the southern Gulf of St. Lawrence undertaken each September (RV survey) provides reliable standardized indices of biomass, spatial distribution and habitat use of commercial-sized male snow crab (*Chionoecetes opilio*) for 2001-2016 and of all snow crab (aggregated index) for 1980-2016. This document provides an update for these indices based on the results of the 2016 RV survey. Of particular note, the RV survey confirmed an important increase in the biomass of commercial-sized adult male snow crab in 2016 as was also estimated by the dedicated snow crab survey. Also, RV surveys since 2012 had captured unusually high numbers of small crabs (≤15 mm) in several areas of the southern Gulf of St. Lawrence, whereas catches in 2016 were considerably lower and at values observed in the late 2000s.

Discussion

There was a question from an industry participant about whether the trawl catchability was different between the day and the night, since the survey operates 24 hours per day. DFO-Science explained that the day-night calibration for snow crab catchability has been calculated and correction factors are applied to the data to convert all the results into day catches.

OVERVIEW OF PHYSICAL ENVIRONMENTAL CONDITIONS IN THE SOUTHERN GULF OF ST. LAWRENCE DURING 2016

The information was presented by Joël Chassé (DFO Science, Moncton, NB).

The presentation provided an overview of 2016 with historical context. There was no working document associated with this presentation but, a summary of the physical environmental conditions relative to snow crab was inserted as a section in WP3.

In summary, 2016 was characterized by a relatively warm winter with lower than normal ice severity. Except for spring, air temperatures had a tendency to be higher than normal. January and November were particularly warm. In September, bottom temperatures were slightly warmer than normal with the exception of the southwest section of Area 12. Bottom temperatures were slightly warmer than 2015 with the exception of the southwest section of

Area 12. Water with temperatures <0°C was still present in September 2016 over the Magdalen Shallows but the volume was less than 2015.

The areal habitat index in 2016 was close to the long-term (1981-2010) average. The mean temperature within the habitat area in 2016 is above the long term average. The combined habitat index is below normal and decreased from 2015.

The deep water (i.e.: Laurentian Channel) are still warming in the Gulf of St. Lawrence and the outcome of this warming event is not known.

Discussion

There were some questions and a discussion around the warming trend of the deep water layer. Clarifications were provided about the flow of water masses in the Gulf of St. Lawrence. The overall circulation consists of a mass of warm water entering the Gulf of St. Lawrence along the bottom and water leaving the gulf along the surface. The deep water entering the gulf consists of a mixture of cold water from the Labrador Current and warm water from the Gulf Stream. In recent years, it seems that the water from the Gulf Stream represents a higher proportion of the water entering the gulf. Climate change models are predicting that the Gulf Stream current would expand north, which may explain what is presently observed.

Harvesters in area 19 have taken interest in monitoring bottom water temperature and have installed numerous temperature recorders at different locations and depths (30 to 90 fathoms). In recent years, harvesters have noted sudden changes in temperatures over the season and sometimes very different temperature fluctuations from adjacent stations. It was explained that sudden changes do occur, especially in coastal areas, and are often due to wind events.

A non-DFO science participant asked if there was a correlation between the abundance and the habitat index. For the moment, the correlation is not very strong. The temperatures used to generate the index are from the month of September and it is not certain if this is the best month to consider temperature for snow crab habitat. More research is needed in this field.

PRECAUTIONARY APPROACH AND RISK ANALYSIS

The information was presented by Marcel Hébert (DFO Science, Moncton, NB).

The estimated commercial biomass available for the 2017 fishery in the sGSL is 99,145 t (87,749 to 111,600 t), which is in the healthy zone of the precautionary approach framework. The decision rule and the corresponding estimated commercial biomass from the 2016 survey of 99,145 t, results in a selected exploitation rate of 44.2% and corresponding to a TAC of 43,822 t for the 2017 fishery.

The fishery recruitment and the commercial biomass (by taking into account the application of the decision rule of 44.2% exploitation rate for the 2017 fishery) are expected to be 46,200 t (31,400 t to 64,230 t) and 77,700 t (61,950 t to 93,600 t), respectively for the 2018 fishery.

Discussion

Some clarifications were requested about the probability for the different catch options presented in the table.

OTHER POINTS OF DISCUSSION AND UPDATE ON PROJECTS ASSOCIATED WITH THE COLLABORATIVE AGREEMENT

Since we were almost at the end of the day, all participants agreed to postpone the revision of the science advisory report the following day. With the time left, it was agreed to address the "Other points of discussion and update on projects associated with the collaborative agreement" which was initially scheduled as the last item of the agenda.

DISCUSSION ON MARINE PROTECTION AREA (MPA)

Industry participants from Area 19 informed that they recently took part of an information session from DFO, where an area of interest off the western coast of Cape Breton, was identified as a potential candidate for MPA. The objective of adding this item to the agenda was to raise the issues with the other snow crab fleets, which may not be aware of the process. A map showing the proposed area and taken from the information session, was presented to all participants. Participants are concerned about the size of the area proposed and the potential impacts on fishing activities, including scientific surveys. They also noted that another area in the Gulf of St. Lawrence (Shediac Valley) was still identified as an area of interest, and posted on the Government web site.

Industry participants requested that Science convey the message to DFO Fisheries Management to bring this issue at the next snow crab consultative meeting in early March 2017. Industry participants were also aware that a Science peer review related to this proposed area of interest was scheduled March 7 and 8, and they all felt that many questions were still unanswered. Industry participants also requested to receive copies of the presentation that was provided in Cape Breton, well ahead of the snow crab consultative meeting. The chair acknowledged the requests and indicated that DFO-Science will convey the requests to the Oceans' group dealing with the MPA file, and Fisheries Management group dealing with the snow crab consultative meeting. The chair also suggested harvesters to contact directly Fisheries Management to formally request the addition of this discussion item on the consultative meeting agenda.

Note: on Feb. 3, 2017, DFO Oceans Management Gulf Region asked to postpone the science peer review

UPDATE ON PROJECTS ASSOCIATED WITH THE COLLABORATIVE AGREEMENT

Mikio Moriyasu presented a short summary of some key ongoing research projects:

- Tagging of snow crab using spaghetti tags is ongoing since 2015. In addition, electronic (i.e.: acoustic) tags are planned for 2017. The tagging project is conducted in collaboration with the science team at the Bedford Institute of Oceanography (BIO).
- The installation of a network of temperature recorders moored at different location in the southern Gulf of St. Lawrence will expand in 2017. The chair suggested the science team to contact Area 19 harvesters to obtain and share the temperature data they have collected with their own recorder network.
- Research projects are being developed on the topics of characteristics and dynamics of skip molters, and ocean acidification in relation to snow crab productivity.
- Improvement will be made to add more automation of the sampling procedures on the survey vessel, especially to accelerate the process of measuring the numerous fish species caught.

REVISION OF THE SCIENCE ADVISORY REPORT

The draft Science Advisory Report (SAR) of the 2016 fishery characteristics, biomass estimates and risk analysis of catch options for 2017 was reviewed by meeting participants on January 26, 2017. The document overall format was similar to the previous year advisory report (DFO 2016). Minor edits were suggested by participants. There was consensus for publishing the proposed Science Advisory Report provided edits discussed at the meeting were adopted in the final version.

MEETING PRODUCTS AND CLOSURE OF MEETING

The meeting was scheduled for two days January 25-26, 2017 but, a winter storm imposed a late start the first day (1:00 pm instead of 10:00 am). Nevertheless, most of the invited participants were able to join the meeting, all agenda items were addressed, and the meeting was an overall success.

There was consensus for publishing the proposed Science Advisory Report: "Assessment of snow crab in the southern Gulf of St. Lawrence (Areas 12, 19, 12E and 12F) and advice for the 2015 fishery", provided edits discussed at the meeting were made in the final version. Efforts were made in the science peer review process to acknowledge and address all comments and concerns raised by participants, provided they were appropriate and within the confines of acceptable peer review practice.

In the following months, the four working papers presented at the meeting are to be upgraded to research documents in support of the advisory report.

The Science Advisory Report, the four research documents and the present proceedings are expected to be posted on the Canadian Science Advisory Secretariat (CSAS) website.

REFERENCES CITED

DFO. 2016. Assessment of snow crab (*Chionoecetes opilio*) in the southern Gulf of St. Lawrence (Areas 12, 19, 12E and 12F) and advice for the 2016 fishery. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2016/010.

APPENDICES

APPENDIX 1. TERMS OF REFERENCE

Stock assessment of the southern Gulf of St. Lawrence snow crab stock to 2016 and catch advice for the 2017 fishery

Regional Peer Review – Gulf Region

January 25 and 26, 2017
Moncton, NB

Chairperson: Marc Lanteigne

Context

In support of DFO Ecosystems and Fisheries Management request for advice, DFO Science Branch Gulf Region undertakes a peer review of the stock status of the snow crab (*Chionecetes opilio*) biological unit of the southern Gulf of St. Lawrence (management areas 12, 12E, 12F and 19).

Objectives

- Develop science advice for the management of the snow crab fishery for the southern Gulf of Saint Lawrence biological unit for the 2017 fishing season. The following considerations and items will be on the agenda for this peer review meeting.
- Present for each of the four management areas in the southern Gulf (12, 12E, 12F, 19):
    - commercial fishery statistics for the 2016 fishing season (catches, landings and effort, sea sampling),
    - indicators of fishery performance: catch per unit of effort, size and carapace condition of commercial size crab.
- Present the following estimates based on the post-fishery directed snow crab trawl survey for the extended polygon of 20 to 200 fathoms for 2016 and previous years:
    - the exploitable commercial biomass (adult male crab of carapace width >= 95 mm) for the southern Gulf biological unit and for each of the four management areas (12, 12E, 12F and 19) within the southern Gulf biological unit,
    - the abundance of male crab recruitment for the near future,
    - the present and future abundance of the spawning stock,
    - the size structure of the male and female crab by stage of maturity,
    - the realized exploitation rates and loss rates of the commercially exploitable biomass.
- Present analyses of indicators of snow crab abundance and distribution based on the September multi-species research vessel survey of the southern Gulf of St. Lawrence.
- Perform a risk analysis of catch options for the 2017 fishery year, including projections with uncertainty of the predicted adult male commercial biomass components (residual biomass, recruitment biomass) for the 2018 fishery year. This risk analysis will be prepared for the southern Gulf biological unit, relative to the reference points (limit, upper reference), and according to the agreed decision rule developed for the southern Gulf of St. Lawrence biological unit and fishery.

- Present the information on the environmental factors which may influence the abundance and population dynamic of the snow crab stock of the southern Gulf of St. Lawrence.

Expected Publications

- CSAS Science Advisory Report on status and fisheries advice of the snow crab biological unit of the southern Gulf of St. Lawrence (management units 12, 12E, 12F, and 19)
- CSAS Proceedings
- CSAS Research Documents

Participation

- Fisheries and Oceans Canada (DFO) (Ecosystems and Oceans Science, and Ecosystems and Fisheries Management)
- Fishing industry
- Aboriginal organizations
- Provinces
- External experts

APPENDIX 2. LIST OF PARTICIPANTS

Name	Affiliation	25 Jan. 2017	26 Jan. 2017
Alan Dwyer	DFO Resource Management, Gulf Region	X	X
Basil MacLean	Area 19 Snow Crab Fishermen's Association	X	X
Brendan Doyle	Gulf Nova Scotia Bonafide Fishermen's Association	X	X
Bruno-Pierre Bourque	Groupe de pêcheurs zone F Inc.	X	X
Daniel Desbois	Association des crabiers de la Baie (ACB)	X	na
Doug Fraser	PEI Fishermen's Association	X	X
Ed Frenette	Micmac Confederacy of Prince Edward Island	X	X
Elmer Wade	DFO Science Gulf Region	X	X
Francis Parisé	Association des Crabiers Gaspésiens (ACG)	X	na
Gérald Chaput	DFO Science Gulf Region	X	X
Hugues Benoit	DFO Science Gulf Region	X	na
Jean Lanteigne	Association des pêcheurs professionnels crabiers acadiens Inc.	X	X
Jean Marc Arseneau	Regroupement des pêcheurs professionnels des Iles-de-la-Madeleine (RPPIM)	X	X
Joël Chassé	DFO Science Gulf Region	X	X
Joël Gionet	Association des crabiers acadiens (ACA)	X	X
Joey Aylward	PEI Snow Crab Fisherman Association	X	X
Kirt Dedam	Listuguj First Nation	X	X
Léonard LeBlanc	Gulf Nova Scotia Fishermen's Coalition	X	X
Marc Lanteigne	DFO Science Gulf Region	X	X
Marcel Hébert	DFO Science Gulf Region	X	X
Mark Boyd	Area 18 Crab Fishermen's Association	X	X
Martin Mallet	Homarus, Union des pêcheurs maritimes (UPM)	X	X
Martin Noël	Association des pêcheurs professionnels crabiers acadiens Inc.	X	X
Matthew Hardy	DFO Science Gulf Region	X	na
Michel Richard	Union des pêcheurs maritimes (UPM)	X	X
Mikio Moriyasu	DFO Science Gulf Region	X	X
Paul Boudreau	Regroupement des pêcheurs professionnels des Iles-de-la-Madeleine	X	X
Pierre deGrâce	DFO Science Gulf Region	X	X
Rémy Rochette	University of New Brunswick, Saint John	X	na

Name	Affiliation	25 Jan. 2017	26 Jan. 2017
Renaud Sylvestre	La Nation Micmac de Gespeg	X	X
Renée Allain	DFO Science Gulf Region	X	X
Rita Cormier	DFO Science Gulf Region	X	X
Robert Haché	Association des crabiers acadiens (ACA)	X	X
Robert MacMillan	PEI Department of Agriculture and Fisheries	X	X
Ronald Heighton	Northumberland Fishermen's Association	X	X
Steven Chiasson	Area 19 Snow Crab Fishermen's Association	X	X
Sylvie Leger	DFO Resource Management Gulf Region	X	X
Tobie Surette	DFO Science Gulf Region	X	X
Tommy Campbell	Area 19 Snow Crab Fishermen's Association	X	X

APPENDIX 3A. INITIAL AGENDA

Wednesday January 25, 2017	**Time**
Meeting room open	9:30 – 10:00
Introduction, review of agenda	10:00 – 10:20
-Description of the 2016 snow crab fishery in the southern Gulf of St. Lawrence (WD01e). -Report of the 2016 trawl survey for snow crab in the southern Gulf of St. Lawrence (WD02e). -The 2016 assessment of the snow crab stock (southern Gulf, areas 12, 19, 12E and 12F) (WD03e).	10:20 – 12:00
Lunch	12:00 – 13:00
-The 2016 assessment of the snow crab stock (southern Gulf, areas 12, 19, 12E and 12F) (WD03e) (continued). -September multi-species survey index (WD04e). -Environmental conditions -Risk analysis and catch options for 2017 (WD03e)	13:00 – 17:00
Break	15:00 – 15:15
Thursday January 26, 2017	
Meeting room open	8:00 – 8:30
-Editing of draft advisory report on status of snow crab from the southern Gulf (all participants). -End of the peer review meeting	8:30 – 10:15
Break	10:15 – 10:30
Update on projects associated with the collaborative agreement	10:30 – 13:00
End of meeting	13:00

APPENDIX 3B. REVISED AGENDA

Wednesday January 25, 2017	**Time**
Meeting room open	9:30 – 13:00
Introduction, review of agenda	13:00 – 13:20
Presentations -Description of the 2016 snow crab fishery in the southern Gulf of St. Lawrence (WD01e). -Report of the 2016 trawl survey for snow crab in the southern Gulf of St. Lawrence (WD02e). -The 2016 assessment of the snow crab stock (southern Gulf, areas 12, 19, 12E and 12F) (WD03e). -September multi-species survey index (WD04e). -Environmental conditions. -Biomass geographic distribution in management areas (WD03e). -Risk analysis and catch options for 2017 (WD03e).	13:20 – 16:30
Other points of discussion and update on projects associated with the collaborative agreement	16:30 – 17:00
Break	15:00 – 15:15
Thursday January 26, 2017	
Meeting room open	8:00 – 8:30
Editing of draft advisory report on status of snow crab from the southern Gulf (all participants)	8:30 – 10:15
End of meeting	10:30

APPENDIX 4. NOTIFICATION MESSAGE OF THE MEETING AND DISTRIBUTION OF SNOW CRAB TRAWL SURVEY DATA, DECEMBER 19, 2016

Hello

You will find as an attachment the notification of the upcoming science peer review meeting of the assessment of the snow crab stock of the southern Gulf of St. Lawrence The meeting will be held at the Days Inn and Suites, 2515 Mountain Road, Magnetic Hill, Moncton (NB).

The meeting will begin at 10:00 AM Wednesday January 25 and should finish no later than 1:00 PM Thursday January 26, 2017.

You may nominate one participant per association for this science review. Please communicate to me the name of the participant before January 17, 2017.

As in previous years, the working documents will be made available, via a website, to anyone who wishes to obtain them, even if they are not participating at the science review.

A notice will be sent when the documents become available at the latest January 18, 2017.

As well, I have attached the data files.

Following on a commitment made by DFO Science Branch to provide access to the data from the southern Gulf of St. Lawrence snow crab trawl survey prior to the annual peer review of the stock assessment, you will find attached the survey data files from the snow crab trawl survey from 2016.

The two files attached are:

"**Explanation of data files 2016.pdf**" which explains the content and format of all the data files.

"**file01_sc_industry_data_2016.txt**" which is the catch data by individual station for all stations sampled in 2016, in text format. This file can be opened with any spreadsheet such as Excel, OpenOffice, import the file as a "tab" delimited file.

You can get a rough estimate of the biomass of snow crab in the Gulf yourself based on the average of the weight captured, per square km, over the 354 stations successfully sampled in 2016.

Biomass in tons per sq. km at each station is calculated as follows:

Weight of crab in kg per square metre at each station can be calculated using: column H gives weight in grams for crab all carapace conditions, column J for crab of carapace conditions 3 to 5 to calculate residual biomass in 2016 divided by 1000 gives weight in kg and divided by the estimated swept area (in square metres) of the trawl at that station (column K) to give kg per square metre.

Multiply each value by 1000 to give tons of crab per square km from all 354 sample stations (you first divide the kg per square metre value by 1000 to give tons per square metre and then multiply by 1 million square metres per square kilometre to give you tons per square kilometre)

Calculate the average tons per square kilometre over the 354 stations, which equals 1.7245 tons per sq. km and multiply this value by the area of the polygon for the southern Gulf (57,840 sq. km) to give you a rough estimate of the biomass (in tons) for the southern Gulf in 2016, which equals 99,126 tons.

Note that this is not the value used in the assessment. The biomass for the assessment is calculated using geostatistics and the value will be different from the approximate value using the arithmetic average.

The data are preliminary. Subsequent quality assurance and verification procedures, including the upcoming science peer review meeting in January 2017, may result in differences between what is currently displayed and what will become the official database. Users should use the information with caution and do so at their own risk. The Government of Canada accepts no liability for the accuracy, availability, suitability, reliability, usability, completeness or timeliness of the data. In no event will the Government of Canada or its employees, servants or agents have any obligation to the user for any reason including claims arising from contract or tort, or for loss of revenue or profit, or for indirect, special, incidental or consequential damages arising from the use of this preliminary information.

Your proceeding beyond this Disclaimer will constitute your acceptance of the terms and conditions outlined above.

Thank you,

Gérald Chaput

Coordinator | Coordinateur
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APPENDIX 5. NOTIFICATION OF DISTRIBUTION OF WORKING PAPERS FOR THE SNOW CRAB REVIEW, JANUARY 17, 2017

Hello.

I will be sending you in a sequence of messages, the four working documents that will be reviewed during the upcoming science peer review meeting of the assessment of the snow crab stock of the southern Gulf of St. Lawrence.

The four documents that will be include:

1) WD01e-fishery performance in 2016.pdf
   This document, in english, summarizes the information specific to the snow crab fishery in 2016.
2) WD02-Survey activities 2016.pdf
   This document, in English only, presents the results of the snow crab trawl survey that was conducted in 2016.
3) WD03e-Assessment of snow crab 2016.pdf
   This document, in english, presents the assessment of the biomass in 2016, the risk analysis of catch options for 2017, and various biological indicators of the snow crab population.
4) WD04e-Research vessel index of snow crab to 2016.pdf
   This document, in English only, presents the indicators of snow crab abundance from the September multi-species research vessel survey.

In this first message, the following document is attached:

1) WD01e-fishery performance in 2016.pdf

Also attached is the proposed agenda for the meeting of January 25 and 26, 2017.

The meeting will begin at 10:00 AM Wednesday January 25 and should finish no later than 1:00 PM Thursday January 26, 2017.

The meeting will be held at the Days Inn and Suites, 2515 Mountain Road, Magnetic Hill, Moncton (NB).

I want to remind you that participation at the science peer review meeting is by invitation and there are no observers or media allowed in the meeting.

Finally, be advised that these documents are working documents and results, interpretation, and subsequently advice may change as a result of the peer review meeting.

Thank you,

Gérald Chaput

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